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## 1) Absolute Maximum Ratings

Absolute maximum ratings	
Parameter	Value
Input voltage to pulsed inputs [1]	60 Vdc
Supply voltage (for psu version) [2]	45V pk-pk 45V dc
Output voltage (across terminals) [3]	60 Vdc
Output current sinking [3]	100 mA
Maximum external supply voltage (for powered versions) [4]	40 Vdc (40Vpk ac 28Vrms)

Table 1: Absolute maximum ratings.

Notes:

[1] Inputs are designed for “volt-free” switches ( reed switches) and have integrated internal weak pull-ups. Inputs will work with open-drain or open collector inputs.

[2] Maximum voltage difference between power supply terminals.

[3] Maximum voltage difference across terminals. Current limited by pull-up resistor on input of other equipment i.e. BMS system. For example: 24V BMS system with a 1 k Ohm resistive pullup on the input will limit the current to 24 mA

[4] Powered version is designed for a nominally 24Vrms A.C. Transformer (Vpk should be approximately 34 Vpk. The powered version will also work with a DC input.

## 2) Recommended Battery

Recommended battery	
Battery type	Nominal voltage: 3.6 V Capacity: 2.6 Ah Battery format: AA Battery Chemistry: Lithium Thionyl Chloride

Table 2: Recommended battery type.

### 3) Output Low Characteristics for different voltages with 1 kOhm Pull UP

Note: 1k Ohm resistor used in all cases

Output Characteristics [1]	
Bias Condition	Output low voltage
3.3 V	4 mV
5 V	12 mV
10 V	28 mV
20 V	72 mV
30 V	100 mV
40 V	140 mV
50 V	180 mV
60 V	240 mV

Table 3: Output "low" characteristics with 1k pull-up resistor.

Notes: [1] Tested on 2 units on all of the outputs leading to a total of 8 output devices.

### 4) Input Low thresholds

Note: The unit is primarily designed for "volt-less" switches and open-drain or open collector connections to the input terminals. The unit should work with other input types e.g. TTL or CMOS as long as the input can be pulled low enough.

Input Low Thresholds	
Condition	Value
Input low voltage thresholds [1]	0.5 V

Table 4: Inputs - Low voltage threshold.

Notes:

[1] Values taken from measurements and data sheet parameters.

Note: If other interfacing levels are required please ask for assistance

## 5) Isolation voltage

BATTERY version isolation

Battery version isolation.	
Circuitry	Isolation voltage [1]
Isolation between input side and output side	13.9 kVdc ; 9.0 kVrms
Isolation between output side outputs	1kVdc; 0.7kVrms

Table 5: Battery version isolation.

Notes: [1] Estimates taken from data sheet parameters and pcb layout.

POWERED version isolation

Powered version isolation	
Circuitry	Isolation voltage
Isolation between input side and output side	No isolation
Isolation between output side circuitry and outputs [1]	1kVdc; 0.7kVrms

Table 6: Powered version isolation.

Notes: [1] Assumes that the power supply circuitry does not share a common connection with external circuitry connected to the output side.

## Dynamic characteristics

### 6) Maximum pulse frequency

Maximum pulse frequency	
Condition – output pulse width setting (ms) [1]	Pulse frequency (pps)
50	10
250	2

Table 7: Maximum pulse frequency.

Notes:

[1] The maximum pulse frequency is ultimately limited by the output pulse width duration and assumes the output pulses will be at approximately 50% duty cycle. e.g. 50ms on / 50ms off

## 7) Minimum input pulse duration

Minimum input pulse duration	
Pulse width (ms)	Test conditions [1] [2]
20 ms	80 ms high 20 ms low continuous pulse train. Open-collector input connections using Avago HCPL-817 optocoupler. No contact bounce. Negative going pulse i.e. switch closure with resistive pull-up

Table 8: Minimum pulse width duration.

Notes:

[1] Will work at this pulse width with “good” reed relays (contact bounce in order of 1-4ms) or reed-switches.

[2] Also tested with RE030012 relays with severe contact bounce (close time and bounce in the order of 10 ms).

A reasonable pulse width and pulse repetition for these relays is 80 ms and 6 pps respectively.

These relays were tested with 20 ms pulse width duration, but there were occasional missing pulses.

Note: sometimes at short pulse width operation these relays could exhibit bounce much greater than 10 ms.

## 8) Nominal debounce time

Nominal debounce time (ms)
10 ms

Table 9: Nominal debounce time.

## 9) Output pulse width variation

Output pulse width variation		
Nominal Pulse duration (ms)	Minimum (ms)	Maximum (ms)
50	50	58
250	250	264

Table 10: Output pulse width variation.

## 10) Estimated battery lifetime (from measurements)

50ms output pulse operation

Estimated Battery Lifetime (from measurements) (1)				
Conditions	Input Side		Output side	
	Average Current (uA)	Expected lifetime (Yrs)	Average Current (uA)	Expected lifetime (Yrs)
<b>** Target Specification **</b> 1 input 4 outputs 200 ms input pulse width 50 ms output pulse width <b>1 pulses per second</b>	11.37	26.17 (9) [2]	26.17	10.97 (9) [2]
1 input 4 outputs 500 ms input pulse width 50 ms output pulse width <b>1 pulses per second</b>	17.8	16.67	As above	As above
1 input 4 outputs 200 ms input pulse width 50 ms output pulse width <b>2 pulses per second</b>	23	12.94	54	5.47
1 input 4 outputs 400 ms input pulse width 50 ms output pulse width <b>2 pulses per second</b>	38	7.7	As above	As above
1 input 4 outputs 50 ms input pulse width 50 ms output pulse width <b>5 pulses per second</b>	33	8.8	129	2.28

Table 11: Estimated battery lifetime 50 ms output.

Notes: [1] Assumes the inputs are not continuously stuck-on (closed).

[2] In all cases the maximum life of the batteries will be 10 years.

250 ms output pulse operation

Estimated Battery Life 250 ms operation	
Condition	Estimated battery life Output side [1]
1 input 4 outputs 200 ms input pulse width 250 ms output pulse width <b>1 pulses per second</b>	2.75 years [2]

Table 12: Estimated battery lifetime 250 ms output.

Notes: [1] The input side estimates will not change from reported values in table 4.

[2] For the same input operating conditions, the 250 ms output time will reduce the battery lifetime by a factor of 4.

SLEEP Mode current (no pulses, Inputs high)

Sleep mode current (no pulses, Inputs high)			
Input		Output	
Current	Years [1]	Current	Years [1]
80 nA	>> 10 years	80 nA	>> 10 years

Table 13: Sleep mode current (no pulses, Inputs high)

Notes: [1] Normal battery life is approximately 10 years maximum.

Stuck on current (one or both inputs continuously closed)

Stuck on current (one or both input permanently closed) [1]		
Condition	Current (uA) [2]	Years
1 input shorted	36	8.2
2 inputs shorted	72	4.1

Table 14: Stuck on current (one or both input permanently closed)

Notes:

[1] Calculated from 3.6 Vdc supply with 100 k Ohm pull up resistor shorted to ground. Also checked through measurements.

[2] Note that if the inputs are stuck on for half of the time the battery life will increase in direct proportion.



## 11) Power supply requirements for powered version

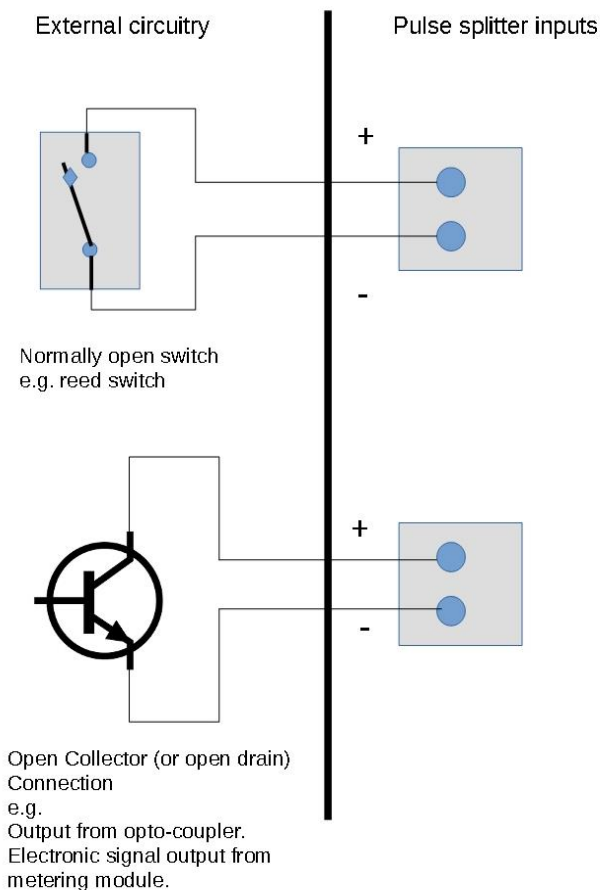
Power supply requirements for powered version	
Parameter	Value
Minimum input voltage	7 Vdc (7 Vpk)
Maximum input voltage	40 Vdc (40Vpk ac 28Vrms)
Typical supply current (see tables 11 and 12 also ) [1] Worst case	400 uA

Table 15: Power supply requirements for powered version

Notes: [1] Worst case operation estimated from 400 ms input pulse 250 ms output pulse at 2 pps.

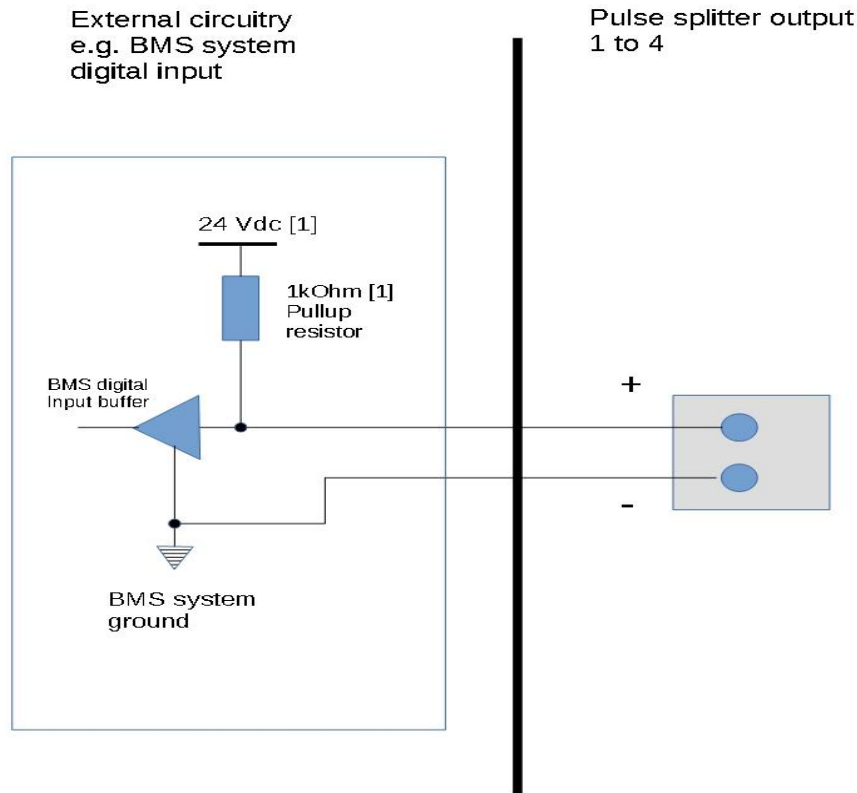
## 2) Input and output connection diagrams

Typical INPUT connections



Typical OUTPUT connections

NOTES:



[1] Typical connection should give 24 mA maximum current through output. Output will cope with up to 100 mA current. Outputs have been tested with 60 Vdc bias and 1 k Ohm pull up resistor. In this case a power resistor was used to cope with resistive heating. If end users want to interface to systems other than standard BMS (e.g. 60 V bias) it is recommended that they inspect resistive pullup values and power ratings. Recommended values for resistive pullups in the range of 1 to 10 kOhm. If other interfacing requirements are required please contact Meters UK 01524 555 929